

Amendment to the Claims:

1. (Amended) An apparatus for performing electromagnetic treatment on processed metallurgical materials and products, said apparatus comprising:
 - a holder for a work piece;
 - a power supply for providing voltage and current to a single electromagnetic coil, said power supply including a means for generating an alternating current component having harmonic shapes with controlled characteristics, a means for imposing a direct current component with a constant bias on said alternating current component, and a means for varying frequency of said alternating current component;
 - a thermal source for varying temperature of said work piece and said single electromagnetic coil;
 - at least one sensor;
 - a data acquisition means for recording data measured by at least one sensor;
 - and
 - a processor for controlling, monitoring, and analyzing at least one operating parameter of said electromagnetic treatment;
 - wherein said power supply is coupled to said single electromagnetic coil such that said alternating current component and said direct current component are carried over said single electromagnetic coil, said holder is located proximate to said single electromagnetic coil, said thermal source is coupled to said holder and said single electromagnetic coil, and said processor is coupled to said power supply, said data acquisition means, and said thermal source.
2. (Canceled)
3. (Amended) An apparatus for performing electromagnetic treatment and thermal-chemical treatments simultaneously on processed engineering materials and products, said apparatus comprising:
 - a holder for a work piece;
 - a power supply for providing voltage and current to a single electromagnetic coil, said power supply including a means for generating an alternating current component having harmonic shapes with controlled characteristics, a means for

imposing a direct current component with a constant bias on said alternating current component, and a means for varying frequency of said alternating current component;

a heating/cooling source for varying the temperature of said work piece and said single electromagnetic coil;

a thermo-chemical treatment system;

at least one sensor;

a data acquisition means for recording data measured by at least one sensor; and a processor for controlling, monitoring, and analyzing at least one operating parameter of said electromagnetic treatment;

wherein said power supply is coupled to said single electromagnetic coil such that said alternating current component and said direct current component are carried over said single electromagnetic coil, said holder is located proximate to said single electromagnetic coil, said heating/cooling source is coupled to said holder and said single electromagnetic coil, said thermo-chemical treatment system is connected to said work piece, and said processor is coupled to said power supply, said data acquisition means, and said thermal source.

4. (Canceled)

5. (Amended) An apparatus for optimizing electromagnetic treatment processes for processed engineering materials and products, said apparatus comprising:

a holder for a work piece;

a power supply for providing voltage and current to a single electromagnetic coil, said power supply including a means for generating an alternating current component having harmonic shapes with controlled characteristics, a means for imposing a direct current component with a constant bias on said alternating current component, and a means for varying frequency of said alternating current component;

a thermal source for varying the temperature of said work piece and said single electromagnetic coil;

at least one sensor, a data acquisition means for recording data measured by at least one sensor;

and a computer for controlling, monitoring, and analyzing at least one operating parameter of said electromagnetic treatment and for adjusting at least one operating parameter based on said data acquired by said data acquisition means;

wherein said power supply is coupled to said single electromagnetic coil such that said alternating current component and said direct current component are carried over said single electromagnetic coil, said holder is located proximate to said single electromagnetic coil, said thermal source is coupled to said holder and said single electromagnetic coil, said computer is coupled to said power supply, said data acquisition means, and said thermal source, said computer uses an Advanced Thermal Analysis (ATA) technique to analyze the thermal signature of said work piece during said electromagnetic treatment.

6. (Canceled)
7. (Canceled)
8. (Canceled)
9. (Canceled)
10. (Canceled)
11. (Canceled)
12. (Canceled)